## FULL CONTENTS

[Claim(s)]

[Claim 1] The laser radiation apparatus with which it is the laser clad processing apparatus which performs laser clad processing in the valve-seat part of an engine cylinder head, and the radiation position was fixed, The table holding a cylinder head, and theta shaft drive mechanism made to rotate said table to the circumference of theta shaft which intersects perpendicularly with this, The X-axis drive mechanism which drives said table to X shaft orientations which intersect perpendicularly with the aforementioned theta shaft, Have the control part which controls the Y-axis drive mechanism which drives said table to Y shaft orientations which intersect perpendicularly with each of the aforementioned theta shaft and said X-axis, and the aforementioned theta shaft, the X-axis and a Y-axis drive mechanism, and [ said control part ] [ the same radii as the control which rotates said cylinder head with the aforementioned theta shaft drive mechanism, and the radii in which the center position of the valve-seat part for processing circles by the revolution of said cylinder head ] The laser clad processing apparatus which is what is controlled so that synchronous control of the control which drives said X-axis and a Y-axis drive mechanism is carried out so that the aforementioned theta shaft may draw a radii locus, and a cylinder head rotates centering on the center position of said valve seat for processing.

[Claim 2] in a laser clad processing apparatus according to claim 1 -- said table -- said cylinder head -- a suction valve shaft -- the aforementioned theta shaft and abbreviation -- the 1st location which becomes parallel, and an exhaust air valve shaft -- the aforementioned theta shaft and abbreviation -- the laser clad processing apparatus including a splash means to make between two locations with the 2nd location which becomes parallel rock.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] By this invention's fixing a laser beam and moving an engine cylinder head A laser beam is irradiated at the valve-seat part of a cylinder head, and it is related with the device to which a cylinder head is especially moved among said apparatus about the laser clad processing apparatus which welds a cylinder-head ingredient and a different ingredient.

[0002]

[Description of the Prior Art] As for the valve-seat part of an engine cylinder head, it is common that the heat resistance or endurance cannot secure enough, but press the sintered alloy of copper systems, such as aluminum bronze, fit, and are formed in the aluminum alloy which constitutes a cylinder head. However, when manufacturing by this approach, there was a problem that the degree of freedom of a design, like there is the need of securing press fit cost was restricted. Then, laser clad processing which welds [ of the valve-seat part of a cylinder head ] a copper system ingredient by a laser beam is developed.

[0003] In order to irradiate a laser beam at a circular valve-seat part, it is necessary to move a beam and a cylinder head relatively. In moving a laser beam, pass a reflection of the mirror of plurality [ laser beam / 102 / which was discharged from the laser oscillation machine 100 ] like drawing 8 . In accordance with the periphery of a valve-seat part, it can irradiate by constituting so that a work piece 104 (cylinder head) may irradiate, and rotating the mirrors 106a and 106b contained in the beam rolling mechanism 106 to the circumference of a shaft 108. Moreover, the beam is made to scan in the direction which intersects perpendicularly with this with a beam scanner 110 simultaneously with dislodging in alignment with said valve-seat part. Processing width is secured, and it is constituted by this so that clad processing may be made to a band-like field.

[0004] Generally the laser beam discharged from a laser oscillation machine does not serve as an axial object about the shaft of a beam. The perimeter of a valve seat is covered by such anisotropy, and there is a problem of uniform processing becoming impossible. Drawing 9 explains this. The cross-sectional configuration of the laser beam 102 is shown in drawing 9 (a). As shown in this drawing, the cross-sectional configuration of the laser beam is usually carrying out elliptical. The locus of the laser beam 102 irradiated by the valve-seat part 112 is shown in drawing 9 (b). A laser beam 102 moves to the sense of the arrow head A of the direction of a periphery in alignment with the valve-seat part 112, and it moves, being scanned in the direction which intersects perpendicularly with an arrow head A simultaneously with this. The anisotropy of a laser beam 102 does not change irrespective of dislodging of these arrow heads A and the direction of B, but, in the case of drawing, irradiation is always performed as an oblong ellipse. Therefore, the angle which the major axis of the ellipse of the scanning direction B and a beam cross section makes changes with the parts of a valve seat. In the C section in drawing, as shown in drawing 9 (c), the major axis of the scanning direction B and

an ellipse is in agreement, but in the D section, as shown in drawing 9 (d), it intersects perpendicularly. When shown in drawing 9 (c), as shown in a diagrammatic chart, incidence energy cannot concentrate near a core and uniform processing cannot be performed covering full. When shown in drawing 9 (d), incidence energy becomes comparatively uniform and good processing can be performed. Thus, when processing it by moving a laser beam, there was a problem that uniform processing could not be performed over the valve-seat perimeter. Of course, if dislodging of a radiation position is rotated with laser oscillation machine 100 itself, the problem of the above-mentioned anisotropy is solvable. However, the apparatus for rotating the laser oscillation machine 100, with the accuracy of the radiation position maintained is needed, a facility is enlarged, and it is not realistic.

[0005] On the other hand, a laser beam is fixed and the apparatus which is made to move the cylinder head which is a work piece, and is processed is shown in drawing 10 . theta shaft drive motor 122 fixed to the base 120 rotates the table 126 holding a cylinder head 124 to the circumference of theta shaft. The rotor plate 128 with which the table 126 was fixed to the drive shaft of theta shaft drive motor 122, The cylinder head 124 is being fixed to this slide block 132 including the guide rail 130 placed in a fixed position on this rotor plate 128, and the slide block 132 which slides along with this guide rail 130.

[0006] A slide block 132 has the dividing hole 134, and these support either the inlet port of a cylinder head, or the exhaust port. That is, the shaft of this dividing hole 134 is in agreement with a valve shaft. Moreover, the lock-pin 136 which can move to theta shaft orientations is arranged, and actuation of this attitude is carried out to the drive shaft of theta shaft drive motor 122 by the lock-pin driving actuator 138. When this lock-pin 136 marches out, it inserts into the aforementioned dividing hole 134, and positioning to the rotor plate 128 of a slide block 132 is performed.

[0007] If theta shaft drive motor 122 rotates where this positioning is made, a cylinder head will rotate focusing on the valve shaft corresponding to [ deduce and ] a hole 134 which the lock-pin 136 inserted. If the laser beam is fixed so that the location which only the radii of the valve seat separated from this valve shaft may be irradiated, clad processing will be performed by the revolution of the aforementioned cylinder head over the valve-seat perimeter. Thus, by being able to make a scanning direction and the major axis direction of a laser beam always intersect perpendicularly, and rotating a cylinder head, if the laser beam is made to fix A beam can be scanned in the direction which is made to move a laser beam along with a circular valve-seat part, and intersects perpendicularly in this dislodging direction. Therefore, the valve-seat part perimeter can be covered and uniform clad processing can be performed.

[0008] When processing it to the next port, the connecting pin 142 is inserted in the connection hole 140 which was made to evacuate the lock-pin 136, deduced, solved engagement in a hole 134, could come, simultaneously was established in the slide block. And it deduces

through the connecting pin 142 and a connection hole 140, and it depends motor 144, sliding dislodging of the slide block 132 is carried out, and the dividing hole 134 corresponding to the port for [ of the following ] processing is deduced in the location of the lock-pin 136. And the lock-pin 136 is inserted in this dividing hole 134. The above action is repeated and the valve-seat part of each port is processed.

[0009]

[Problem to be solved by the invention] [ conventionally which is shown in drawing 10 as mentioned above, according to the apparatus, can cover the valve-seat perimeter, and can perform uniform processing, but ] Whenever processing of one valve seat was completed, the above dividing needed to be performed to the following valve seat, and there was a problem that this dividing action will take much time. In particular, engagement of the connecting pin 142 and a connection hole 140 and separation were performed for every dividing action, and much time was spent on this.

[0010] Moreover, as for the starting position and end position of clad processing, it is not necessarily desirable to begin from the location which a cylinder head 124 turns to horizontally as shown in drawing 10 for an adjoining valve-seat part, the water passage location of cylinder-head 124 core, etc. When processing end position is locations other than the location where a cylinder head 124 is shown in drawing When it was except the location where it is necessary to once return a cylinder head 124 to the location shown in drawing in in the case of a dividing action and, and a processing starting position is shown in drawing, the table 126 needed to be rotated to the after-deduction starting position, and these had also taken time.

[0011] Furthermore, since the pitch usually differs an exhaust port in an inlet port, a slide block 132 cannot be used for the both sides of intake air and exhaust air. Therefore, after processing of the port which is one side first is completed, the port of another side will be processed. For this reason, 2 processing apparatus as shown in drawing 10 are prepared, and he processes the valve-seat part of an inlet port by one side, and was trying to process the valve-seat part of an exhaust port on the other hand. However, the cylinder head 124 had to be again put on another side from one processing apparatus in this case, and this time and effort also had the problem of being what requires time. Moreover, 2 apparatus were also needed and these establishment tooth spaces were required. Of course, the slide block for intake air and exhaust ports is prepared separately, and although it is also possible to rearrange these, the time of a provision substitute is needed also in this case.

[0012] Furthermore, also when a certain amount of clearance was required, this clearance deduced and lowering of accuracy, as a result lowering of processing accuracy were caused, it was in the lock-pin 142 and the connection hole 140.

[0013] It is made in order that this invention may solve the above-mentioned trouble, and uniform processing is performed over the perimeter of a valve-seat part, and it aims at offering

the laser clad processing apparatus which can shorten the time which dividing takes, and the time which a provision substitute takes.

[0014]

[Means for solving problem] [ the laser clad processing apparatus concerning this invention ] in order to attain the above-mentioned object The laser radiation apparatus with which it is the apparatus which performs laser clad processing in the valve-seat part of an engine cylinder head, and the radiation position was fixed, The table holding a cylinder head, and theta shaft drive mechanism made to rotate said table to the circumference of theta shaft which intersects perpendicularly with this, It has the control part which controls the X-axis drive mechanism which drives said table to X shaft orientations which intersect perpendicularly with the aforementioned theta shaft, the Y-axis drive mechanism which drives said table to Y shaft orientations which intersect perpendicularly with each of the aforementioned theta shaft and said X-axis, and the aforementioned theta shaft, the X-axis and a Y-axis drive mechanism. And said control parts are the same radii as the control which rotates said cylinder head with the aforementioned theta shaft drive mechanism, and the radii in which the center position of the valve-seat part for processing circles by the revolution of said cylinder head. Synchronous control of the control which drives said X-axis and a Y-axis drive mechanism is carried out so that the aforementioned theta shaft may draw a radii locus, and it controls so that a cylinder head rotates centering on the center position of said valve seat for processing.

[0015] Since according to the above-mentioned architecture a laser beam is fixed, a cylinder head is rotated and clad processing is performed, it is processible by making the scanning direction of a beam, and the major axis direction of the cross-sectional configuration of a beam always intersect perpendicularly. Therefore, the valve-seat part perimeter can be covered and uniform processing can be performed.

[0016] Moreover, this can be rotated centering on the arbitrary locations of a cylinder head by carrying out synchronous control of the three shafts of theta shaft, the X-axis, and the Y-axis. Therefore, after processing one valve-seat part, the dividing action for processing the following valve-seat part becomes easy, and abbreviation of floor to floor time is attained. Moreover, lowering of the processing accuracy accompanying dividing can also be controlled.

[0017] furthermore, said table -- said cylinder head -- a suction valve shaft -- the aforementioned theta shaft and abbreviation -- the 1st location which becomes parallel, and an exhaust air valve shaft -- the aforementioned theta shaft and abbreviation -- a splash means to make between two locations with the 2nd location which becomes parallel rock shall be included

[0018] According to this architecture, the valve-seats part of an inlet port and an exhaust port can be continued and processed with one processing apparatus, and the time which a provision substitute etc. takes can be shortened.

[0019]
[Mode for carrying out the invention] The form of suitable operation of the laser clad processing apparatus concerning this invention is hereafter explained according to Drawings.
[0020] Drawing 1 and drawing 2 are drawings showing the outline architecture of this embodiment, drawing 1 is a perspective view and drawing 2 is a side elevation. About 45 degrees inclines to a base 10 from a horizontal plane, the Y-axis guide rail 12 is arranged, and the Y-axis slide block 14 which can slide is arranged along with this on this Y-axis guide rail 12. The Y-axis slide block 14 can slide on the Y-axis guide rail 12 top, and can control Y axial position of the Y-axis slide block 14 by the Y-axis drive motor 16, the Y-axis ball screw 18, etc. by therefore controlling a revolution of the Y-axis drive motor 16.
[0021] The X-axis guide rail 20 is arranged in the direction which intersects perpendicularly with the Y-axis guide rail 12, and the X-axis slide block 22 which can slide is arranged along with this on this X-axis guide rail 20 at this Y-axis slide-block 14 top. Control of movement magnitude is made in X shaft orientations where said Y-axis and this X-axis slide block 22 cross at right angles by the X-axis drive motor 24 and the X-axis ball screw 26.
[0022] On the X-axis slide block 22, theta shaft table 28 supported pivotable around theta shaft Atheta which intersects perpendicularly with the both sides of the X-axis and the Y-axis is arranged. On this theta shaft table 28, it is arranged at the splash device 30 and the head hold jig 32, and fixed holding of the cylinder head 34 is carried out to this head hold jig 32. theta shaft table 28, the splash device 30, and the head hold jig 32 are united as holding tables holding a cylinder head 34, and rotate the circumference of theta shaft Atheta. This holding table and cylinder head 34 are rotated with theta shaft drive motor 42 through 2 reduction gears 36 and 38 and reducer 40 which get into gear.
[0023] The drive motors 16, 24, and 42 of these 3 shaft are systematically controlled by a control part (not shown), and can make arbitrary sense move a cylinder head 34 to arbitrary locations in an XY plane again. That is, it can be made to move to the sense and parallel illustrating a cylinder head 34 by controlling a revolution of the Y-axis drive motor 16 and the X-axis drive motor 24. Moreover, by controlling a revolution of theta shaft drive motor 42, it can be made to be able to rotate from the location illustrating a cylinder head 34, and the sense can be changed.
[0024] Moreover, a cylinder head 34 is fixable to 2 locations with the splash device 30. The inlet port 44 and the exhaust port 46 are arranged along with the arranging direction of a cylinder at the cylinder head 34, respectively. In drawing 1 , the cylinder head of four valves is shown by the 4-cylinder per cylinder, and the condition that the arranging direction of the cylinder was in agreement with X shaft orientations is shown. Therefore, in drawing 1 , intake air and an exhaust port are arranged respectively in X shaft orientations. The 1st oscillation position shown in drawing 2 is a location where the suction valve shaft AIN and theta shaft

Atheta become parallel, and processes the valve-seat part of an inlet port in this location. In processing the valve-seat part of an exhaust port, a cylinder head 34 is made to rock centering on a splash shaft parallel to a cylinder arranging direction, and as shown in drawing 3 , the exhaust air valve shaft AEX and theta shaft Atheta fix to the 2nd oscillation position which becomes parallel.

[0025] And a laser beam 48 is irradiated from right above at a predetermined valve-seat part, and clad processing is performed.

[0026] The detail of the valve-seat part at the time of clad processing (intake-air side) is shown in drawing 4 . The valve-seat side 50 which makes the suction valve shaft AIN and the include angle of about 45 degrees so that it may illustrate is formed in the inlet part of the combustion chamber 52 of the inlet port 44. Therefore, it turns out that this valve-seat side 50 is a part of side face of the circular cone of 90 degrees of vertex angles centering on the suction valve shaft AIN. Since the suction valve shaft AIN is parallel to theta shaft Atheta as mentioned above, about 45 degrees leans to the horizontal plane, therefore the lowermost end part of the aforementioned valve-seat side 50 has become almost level, and the powder 54 of the charge of a cladding material is supplied on this. If a laser beam 48 is irradiated here, the powder 54 of the charge of a cladding material and a part of cylinder head 34 will melt, and the charge of a cladding material will be welded. And if a cylinder head 34 is rotated centering on the suction valve shaft AIN, clad processing will be performed over the perimeter of the valve-seat side 50. In addition, a actual valve seat is further formed of cutting after this.

[0027] However, since theta shaft Atheta of this embodiment and the suction valve shaft AIN are not necessarily in agreement, a cylinder head 34 cannot be rotated around the suction valve shaft AIN only by controlling theta shaft. Then, in this embodiment, it was made to synchronize with control of theta shaft, control of the X-axis and the Y-axis was also performed, and rotary motion of the aforementioned cylinder head 34 is realized.

[0028] Control of these three shafts is explained using drawing 7 from drawing 5 . The condition of having seen the cylinder head 34 by which fixed holding was carried out to the holding table from the upper part of the direction of theta shaft Atheta is shown in these drawings. And the case where it is processed to the valve-seat part 50-1 of one suction valve port of a No. 1 cylinder is shown.

[0029] Drawing 5 is drawing explaining the control about theta shaft Atheta. It is a holding table by theta shaft drive motor 42 Angular-velocity omega1 If it drives, a cylinder head 34 will rotate theta shaft Atheta as a shaft. The suction valve shaft AIN of the suction valve port which serves as an object for processing at this time is angular-velocity omega1, drawing the radii of radii R for the perimeter of theta shaft Atheta, when distance with theta shaft Atheta is set to R. It goes around.

[0030] Drawing 6 is drawing explaining the control about the X-axis and the Y-axis. If the X-

axis and the Y-axis drive motors 24 and 16 are driven, a condition parallel to the location illustrating a cylinder head 34 can be maintained, and it can be made to move. When processing the valve-seat part 50-1, theta shaft Atheta is the radii of radii R centering on the processing starting position of the suction valve shaft AIN Angular-velocity omega1 Control of the X-axis and the Y-axis is performed so that it may draw. Therefore, theta shaft Atheta and the suction valve shaft AIN are the radii locus T1 of radii R, and T2. It draws.

[0031] If control of the above-mentioned theta shaft and control of the X-axis and the Y-axis are performed simultaneously, as it is shown in drawing 7 , a cylinder head 34 is angular-velocity omega1 centering on the suction valve shaft AIN. It rotates.

[0032] In order to process other suction valve ports, it is processible if theta shaft, the X-axis, and the Y-axis are controlled, location doubling is performed so that the valve-seat part of the port used as the object for processing may serve as a radiation position of a laser beam 48, and the above-mentioned action is performed. At this time, the processing starting position of the valve-seat part should select the most desirable location in consideration of the thickness of the machining part of a cylinder head etc. Therefore, the sense of the cylinder head 34 at the time of processing initiation does not necessarily serve as a direction whose cylinder parallel direction corresponds with X shaft orientations, as shown in drawing 5 etc. According to this embodiment, in parallel to uniting a valve-seat part with the radiation position of a laser beam, the sense of a cylinder head 34 can be made into the desirable sense by control of theta shaft, the X-axis, and the Y-axis. Thus, since the sense of a cylinder head is not changed after [ which is shown in drawing 10 ] the valve-seat part for processing is deduced like an apparatus before, the time which dividing takes can be shortened.

[0033] Moreover, since a cylinder head 34 can be rotated centering on the arbitrary locations of a cylinder head 34, the time which deduces also from this field and is required is shortened.

[0034] Furthermore, since the cylinder head is rotated even if anisotropy is in a laser beam, the direction of the major axis of a beam cross section and the scanning direction of a beam can always intersect perpendicularly, therefore the perimeter of a valve-seat part can be covered, and uniform clad processing can be performed.

[0035] In addition, in this embodiment although the laser clad processing apparatus was explained Also in the machine tool which uses the usual cutter tools, such as a miller, by controlling three shafts, theta shaft, the X-axis, and the Y-axis, like this embodiment, a revolving shaft can be set as the arbitrary locations of work-piece piece (cylinder head), and it is possible to expand the degree of freedom of processing.

[0036]

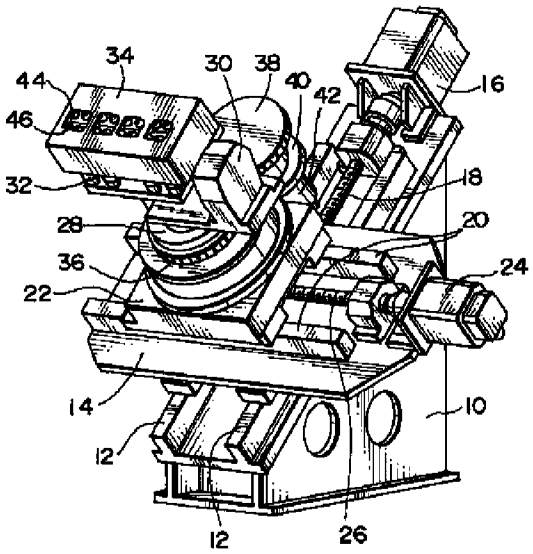
[Effect of the Invention] Since a laser beam is fixed, a cylinder head is rotated and clad processing is performed according to this invention as mentioned above, it is processible by making the scanning direction of a beam, and the major axis direction of the cross-sectional

configuration of a beam always intersect perpendicularly. Therefore, the valve-seat part perimeter can be covered and uniform processing can be performed.
[0037] Moreover, this can be rotated centering on the arbitrary locations of a cylinder head by carrying out synchronous control of the three shafts of theta shaft, the X-axis, and the Y-axis. Therefore, after processing one valve-seat part, the dividing action for processing the following valve-seat part becomes easy, and abbreviation of floor to floor time is attained. Moreover, lowering of the processing accuracy accompanying dividing can also be controlled.
[0038] Moreover, by holding a cylinder head rockable among 2 locations, the valve-seats part of an inlet port and an exhaust port can be continued and processed with one processing apparatus, and the time which a provision substitute etc. takes can be shortened.

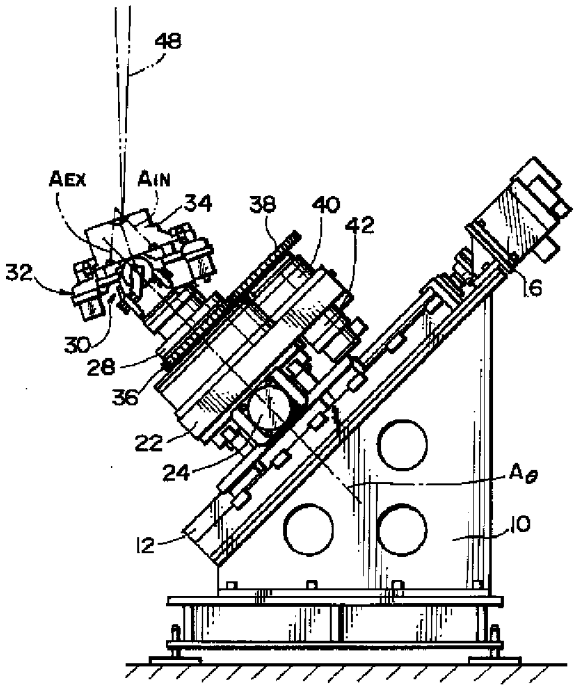
---

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view showing the architecture of the form of operation of the laser clad processing apparatus concerning this invention.
[Drawing 2] It is the side elevation of the form of this operation, and a cylinder head is in the location which processes the intake-air side.
[Drawing 3] It is a side elevation near the holding table of the form of this operation, and a cylinder head is in the location which processes an exhaust side.
[Drawing 4] It is detail drawing of the valve-seat part which performs laser clad processing.
[Drawing 5] It is drawing for explaining control of this embodiment, and is drawing for explaining especially control of theta shaft.
[Drawing 6] It is drawing for explaining control of this embodiment, and is drawing for explaining especially control of the X-axis and the Y-axis.
[Drawing 7] It is drawing for explaining control of this embodiment, and is drawing for explaining a actual motion of a cylinder head.
[Drawing 8] It is drawing showing the architecture of the conventional apparatus, especially the architecture which processes it by moving the radiation position of a laser beam.
[Drawing 9] It is drawing for explaining the trouble of an apparatus conventionally which is shown in drawing 8 .
[Drawing 10] It is the perspective view showing the architecture of other conventional apparatus.
[Explanations of letters or numerals]
14 A Y-axis slide block, 16 A Y-axis drive motor, 22 An X-axis slide block, 24 An X-axis drive motor, 28 theta shaft table, 30 A splash device, 34 A cylinder head, 42 theta shaft drive motor, 44 An inlet port, 46 An exhaust port, 48 Laser beam.

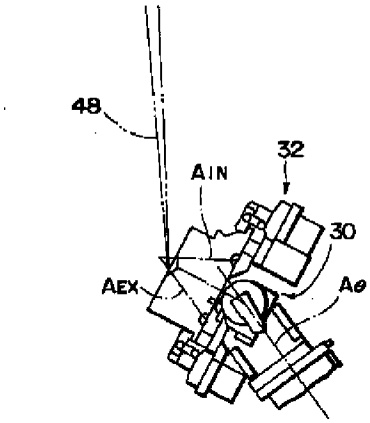
[Drawing 1]



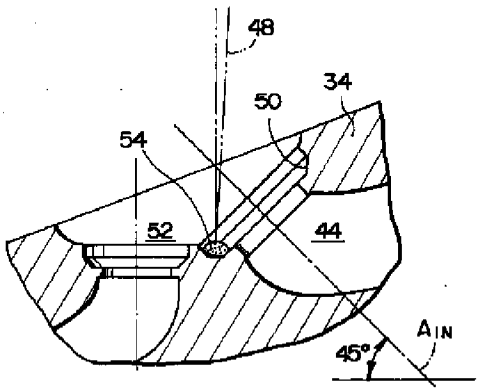

[Drawing 2]



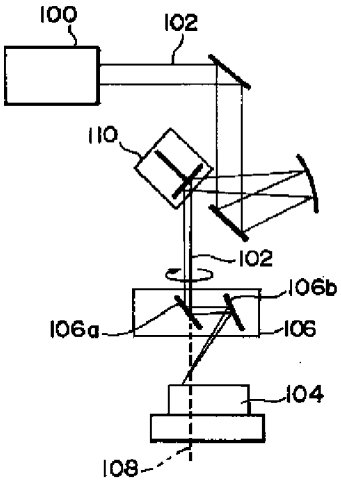

[Drawing 3]



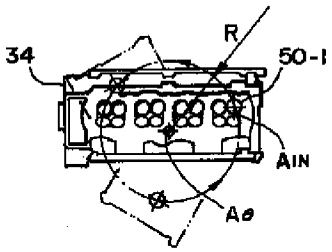

[Drawing 4]



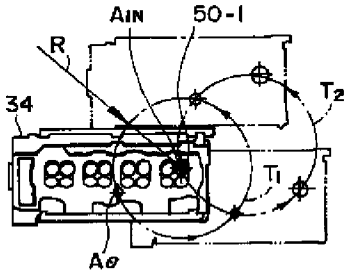

[Drawing 8]



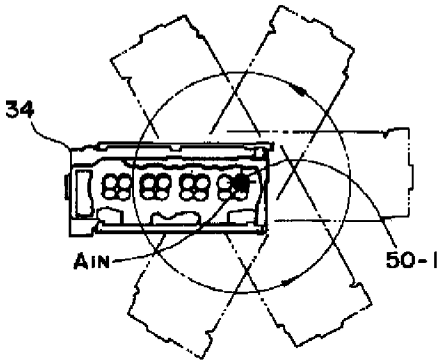

[Drawing 5]



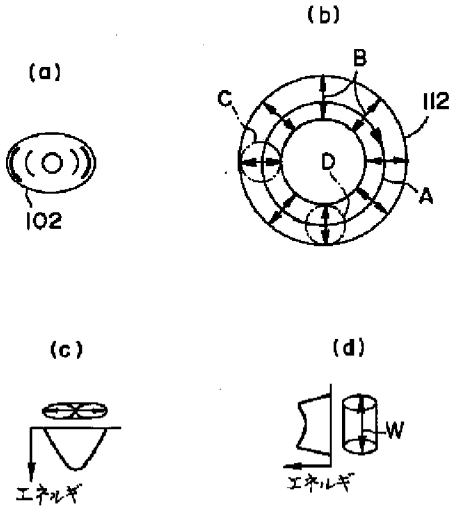

[Drawing 6]



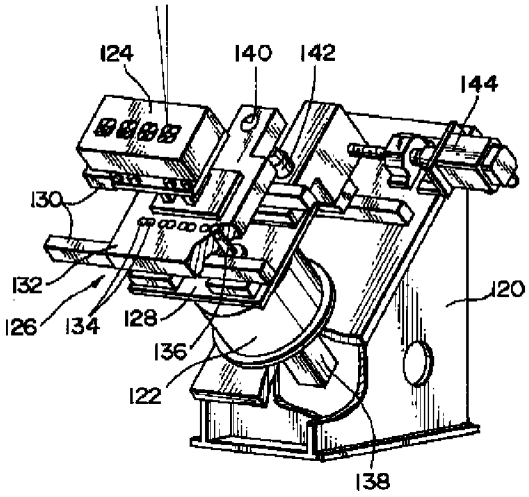

[Drawing 7]




[Drawing 9]




[Drawing 10]




[Translation done.]